

Cordilleran Montane Forest



General Description

The *Cordilleran Montane Forest* zone occurs at mid-to high elevations, primarily in the mountain systems of south-central British Columbia (BC) and western Alberta, below treeline. Altogether, it covers an area of approximately 218,000 km² in the Rocky Mountains, Columbia Mountains, the southern Omineca and Skeena Mountains, and the eastern (leeward) side of the Cascade and southern Coast Mountains. A small expression of this zone also occurs at the highest elevations of the Cypress Hills in southern Alberta and Saskatchewan. This zone represents the northern portion of temperate high montane and subalpine forests found throughout the Rocky Mountains and Intermountain West region of North America, extending south to Texas. Orographic influences create highly variable climatic conditions. Landcover is dominated by evergreen coniferous forests and woodlands.

Vegetation

On most upland sites dominant vegetation varies from continuous closed forests, at lower and mid-elevations, to short-statured open woodlands in a parkland landscape at subalpine elevations. Canopies mostly comprise evergreen coniferous tree species, although some cold-deciduous broad-leaved species are found in mid-elevation montane forests. Treed stands become more open and patchy on steep slopes and with increased elevation, often occurring as tree islands or ribbons in a matrix of grasslands, meadows or shrublands at treeline. At

the highest elevations or on sites most exposed to wind, trees develop characteristic krummholtz growth forms in response to physical damage by extreme cold and blowing snow and ice crystals. Understory structure varies from dense to sparse, and is usually dominated by cold-deciduous or evergreen broad-leaved shrubs, conifer regeneration and perennial herbs. Most forests and woodlands have a well-developed bryophyte and/or lichen layer on the forest floor.

These forests and woodlands are subject to regular stand replacement or significant modification by wildfire, avalanches, windthrow and insect outbreaks. Stand structure is simple and even-aged after stand-replacing fire, but generally becomes multi-storied as succession proceeds. Fire cycles are shorter and insect outbreaks more frequent in the climatically drier areas of the zone. At high elevations, woodland and parkland stands burn less frequently due to cooler temperatures, later-melting snowpack, greater precipitation, lower incidence of dry lightning, and more open or patchy tree distribution. In the subalpine, the cold humid environment and short growing season hamper regeneration of trees, so stand development usually takes longer than on comparable sites at lower elevations. Forest harvesting is a significant disturbance factor in many lower and mid-elevation areas, but agriculture and other human modification of the landscape is relatively minor overall.

Dominant tree species throughout the zone are subalpine fir (*Abies lasiocarpa*), Engelmann spruce (*Picea engelmannii*), lodgepole pine (*Pinus contorta* var. *latifolia*) and interior spruce (*Picea engelmannii* x *glauca*). White spruce (*Picea glauca*) occurs at lower elevations (i.e., approximately <1100 mASL) of the Alberta Foothills and in the Cypress Hills. Rocky Mountain Douglas-fir (*Pseudotsuga menziesii* var. *glauca*) and trembling aspen (*Populus tremuloides*) are common in mid-elevation montane forests, especially on warm aspects.

Understories vary from dense, species-rich shrub and herb conditions to a continuous bryophyte or lichen ground cover with only a few erect vascular plants. Species diversity is generally high, and varies with environmental conditions. Common understory shrubs include mountain huckleberry (*Vaccinium membranaceum*), white-flowered rhododendron (*Rhododendron albiflorum*), grouseberry (*V. scoparium*) and false azalea (*Menziesia ferruginea*). Characteristic herb/dwarf shrub species include arnicas (*Arnica cordifolia*, *A. latifolia*), five-leaved dwarf bramble (*Rubus pedatus*), three-leaved foamflower (*Tiarella trifoliata*), Sitka valerian (*Valeriana sitchensis*), single-flowered clintonia (*Clintonia uniflora*), oak fern (*Gymnocarpium dryopteris*) and green false hellebore (*Veratrum viride*). Bryophytes include red-stemmed feathermoss (*Pleurozium schreberi*), broom mosses (*Dicranum* spp.), ragged mosses (*Brachythecium* spp.) and leafy liverworts (*Barbilophozia* spp.). On dry sites, especially under open canopies, ground lichens (especially clad [*Cladonia* spp.], reindeer [*Cladina* spp.] and pelt [*Peltigera* spp.] lichens) are prevalent.

Subalpine heaths and meadows are common at the highest elevations of this zone, interspersed with clumps of stunted trees. Heath communities, mostly comprising moss heathers (*Cassiope* spp.) and mountain heathers (*Phyllodoce* spp.), usually occur near treeline in areas with late-lying snowbeds. Subalpine meadows occur on moist sites that often have mobile soils, through processes like soil creep, ravelling or bioturbation; these conditions encourage herb growth and limit shrub and tree establishment. They are characterised by a large diversity of forbs, often with showy flowers, including Sitka valerian (*Valeriana sitchensis*), arrow-leaved ragwort (*Senecio triangularis*), wandering fleabane (*Erigeron peregrinus*), paintbrushes

(*Castilleja* spp.) and Indian hellebore (*Veratrum viride*).

In the climatically drier parts of the zone, grasslands occur at all elevations on south-facing slopes, and are typically dominated by fescues (especially mountain rough fescue [*Festuca campestris*], Idaho fescue [*F. idahoensis*], green fescue [*F. viridula*]). Avalanche tracks, often dominated by Sitka alder (*Alnus viridis* ssp. *sinuata*), are common features in steep terrain.

Treed wetlands are dominated by subalpine fir and spruces. Fens dominated by sedges (often water sedge [*Carex aquatilis*]), narrow-leaved cottongrass (*Eriophorum angustifolium*) or willows (e.g., Barclay's willow [*Salix barclayi*]) are common in poorly drained locations at higher elevations. Shrub carrs/swamps occur on imperfectly to poorly drained slopes and in cold valleys, and are characterized by arctic dwarf birch (*Betula nana*) or willows (e.g., grey-leaved willow [*S. glauca*], short-capsuled willow [*S. brachycarpa*] or Barclay's willow).

Climate

The climate of the *Cordilleran Montane Forest* zone is generally characterized by cold, snowy winters and moderately short, cool summers. Latitudinal and orographic influences significantly modify climatic characteristics across the zone, generating highly variable regional to local climates. Slope and aspect control site-scale patterns of insolation, snow deposition and melting; southerly and westerly slopes are warm aspects where snowmelt occurs earlier in the spring, and northerly and easterly slopes are cool aspects where snowmelt is later and wind deposition of snow is often greater.

Mean annual temperatures vary from approximately -1°C to +4.5°C; warmer temperatures are associated with mid-elevation montane areas and colder temperatures with subalpine areas near treeline. At higher elevations, frost is possible in any month and occurs most frequently in locations with cold air drainage or ponding, such as closed topographic depressions. The growing season is short, averaging less than 800 growing degree days above 5°C (GDD), although mid-elevation montane locations can average >1000 GDD. Climatically drier areas receive as little as 400 mm of total precipitation annually, whereas areas within wetter subregional climates

can receive >2000 mm. The mid-elevation montane areas of Alberta and southern BC typically receive the lowest total precipitation (400-650 mm) and the lowest snowfall (approximately 150-450 cm). Subalpine areas receive more snow, often constituting the majority of total annual precipitation, varying from approximately 330 to >1500 cm. Snow depth varies locally, with some sites nearly snow-free because of high winds, while snow accumulation is high on lee slopes and in forest openings; in some areas, late-melting snowbeds provide the majority of growing season moisture.

Physiography, Geology, Topography and Soils

This zone primarily occurs in the southern portion of the Cordilleran physiographic region, including most mountain ranges and high plateaux of interior BC, the Rocky Mountains, and the Rocky Mountain foothills of western Alberta. The zone occupies mid-to high elevations in the Skeena, Omineca and Rocky Mountains south of approximately latitude 57°30'; along the eastern side of the Coast Mountains as far north as the Yukon border; and in the Columbia and Cascade Mountains, Columbia Highlands and Interior Plateau of south-central BC. In Alberta, the Rocky Mountain foothills south of approximately the Bow River are included in this zone, as are the highest elevations of the Cypress Hills of southeastern Alberta and southwestern Saskatchewan. Depending on the location, elevations range from as low as 950 – 1000 mASL to treeline (as high as 2500 mASL).

The Coast and Omineca Mountains consist predominantly of crystalline igneous and metamorphic rocks, while the rest of the Interior and Eastern Systems of the Cordillera, as well as the Cypress Hills, comprise faulted and folded Paleozoic,

Mesozoic or Tertiary sedimentary, and often carbonate-rich, rocks. The terrain is a complex mixture of high mountains (up to 3900 mASL) with intervening plateaux, hill systems, valleys, trenches and basins.

Except for the highest parts of the Cypress Hills, the zone was affected by late Pleistocene glaciation. The main surficial material is glacial till, often occurring as a thin veneer overlying bedrock. At higher elevations and on steep slopes, colluvial materials predominate. Variable topography produces rapid and frequent changes in site-scale aspect, moisture and nutrient status. Mineral soils are typically Podzols, Brunisols and Luvisols; Gleysols develop in moist, poorly drained topopositions. Volcanic ash is a common upper soil layer in southern portions of the range.

Notes

Montane conditions to the north of the *Cordilleran Montane Forest* zone are included in the *Northwestern Boreal Forest* and, to the west, in the *Pacific Montane Forest*. The *Western Boreal Alpine Tundra* and *Cordilleran Alpine Tundra* occur at higher elevations, above treeline. At lower elevations on the east side of the Rockies, and a few areas in northwestern BC, the *West-Central Boreal Forest* is adjoining. In central and southern BC, the *Cordilleran Rainforest*, *Cordilleran Dry Forest* and *Cordilleran Subboreal Forest* zones constitute the lower elevation boundaries. To the south, this zone continues into the United States.